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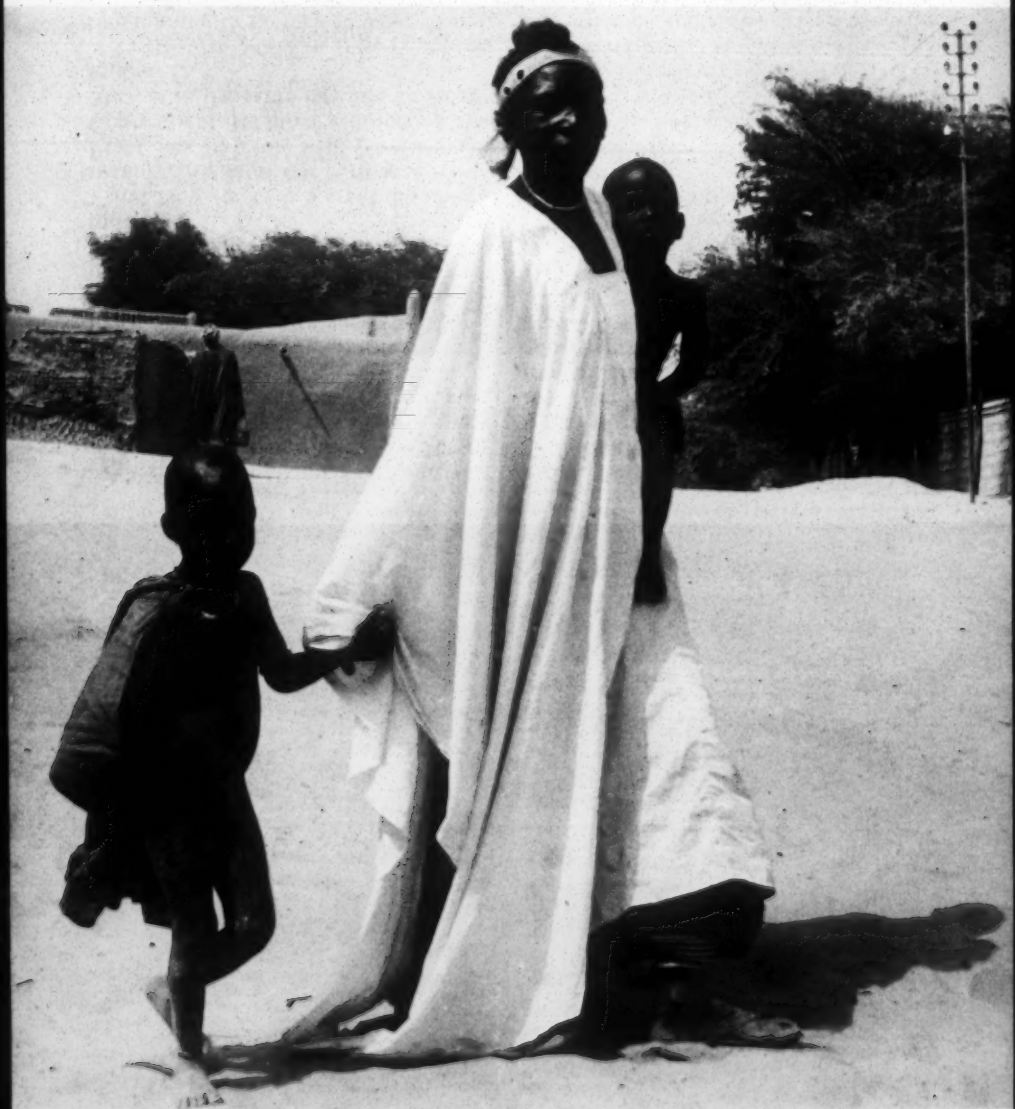

TIMBUKTU — Pole and wires add a modern note to this mud-walled African city

also — *New Jersey, Amateur Astronomers, Whooping Cranes, Farthest Planets* 241

UMI

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factures: some 300 types of goods from delicate electronic instruments to gaudy plastic toys, from machinery to chemicals, from leather to paint, jewelry to beer. But New Jersey still manages to earn its nickname, "Garden State." Part of the "garden" cuts across sections of 10 South Jersey counties. There grow yellow and green fields of lettuce and asparagus shoots, rows of blue-black eggplant, crimson peppers, orchards pink with peaches, and vines red with tomatoes.

Slicker-clad "rainmakers" (below) water broccoli with a 14-million-gallon-a-day sprinkler. Supermarkets all over the country will stock the beets, spinach, corn, peas, and lima beans that are grown and frozen on this 16,000 acre vegetable patch—Seabrook Farms, near Bridgeton.

Greenhouses in Middlesex Borough grow more than a million orchids each year. On the pastures of Jobstown thoroughbred horses are reared.

New Jersey is also a transportation center. New York-bound trains from the south and west halt in Jersey City, Hoboken, or Weehawken. Passengers and cargo are then ferried across the Hudson. Railroad barges equipped with tracks for freight cars (above) are nosed across by tugs. A million vehicles

NATIONAL GEOGRAPHIC PHOTOGRAPHERS B. ANTHONY STEWART, ROBERT F. SISSON, ABOVE

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NEW JERSEY— Industry's Mighty Giant

NATIONAL GEOGRAPHIC PHOTOGRAPHER VOLKMAR WENTZEL; COVER - C. TRIESCHMANN, BLACK STAR

AT A LEGAL 60 miles an hour your car sings along the New Jersey Turnpike. You spend two hours going through the State—longer if you stop for lunch.

You get a fleeting impression of fields and farms, of a sprawling tank farm hoarding millions of gallons of petroleum (above), an airport with lights winking through the haze of industry.

But New Jersey is a great deal more than this. Its most northern spot, High Point, lies on a line with New Haven, Connecticut. Its most southern, Cape May, is in the same latitude as Washington, D. C.

Forty-fifth State in size, it acts as one mammoth factory sucking in raw materials and pouring out everything from perfume to aircraft carriers. Yet in the southern Pine Barrens covering nearly one-fourth of the State, people earn a living gathering moss, picking laurel and pine cones, cutting pulpwood, and even selling rattlesnakes.

Though New Jersey would fit into neighboring New York six times and leave more than enough room for nearby Delaware, only six States annually outproduce this mighty midget.

A list of plants is an industrial honors list: Bell Telephone Laboratories, E. I. du Pont de Nemours, Radio Corporation of America, Campbell Soup Company, Owens-Illinois Glass Company, Lenox China Company, Esterbrook (pens).

From assembly lines roll nightgowns, work shirts, electronic brains, adhesive tape, pipes, snuff, cigarette paper, cigars, wall-to-wall carpeting, linoleum, electric trains, bowling balls, hot dogs, automobiles, television sets, soap, sulphuric acid, airplane motors, rocket engines, sewing machines, yachts, and, indeed, kitchen sinks.

Newark holds a neither proven nor disproven claim that it is unmatched anywhere for the variety of its manu-

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gather on the steps of Blair Hall, English and Scottish machinists, and

LAMA IN NEW JERSEY —Kalmuk immigrants are Buddhists, look to Tibet's Dalai Lama for spiritual leadership. Of the world Kalmuk population of 135,000, some 250 live near Farmingdale. Outside the little temple, they become Americanized Teen-agers watch television, study to enter American colleges, picnic on Saturdays, and drive late-model cars.

Irishmen who built railroads and canals. Armenians, Frenchmen, Italians, Swiss, Slavs, and Estonians came later. Japanese-Americans chased from the west coast during World War II came east. Many stayed. The newest immigrants are the Kalmuks, descendants of western Mongols who fought Genghis Khan.

If all this isn't enough for one State, New Jersey can always point to its playground, the Jersey shore. Every summer fishermen, sunbathers, swimmers, and water skiers from all over the United States swell the coastal population from Sandy Point to Cape May. Nearly one-fourth of the vacationers go to Atlantic City, largest of the State's seaside resorts. Huge hotels line the beach where roller chairs glide the famous five-mile Boardwalk (below). In this city aglitter with neon lights Miss America is crowned every year. Conventions keep the hotels open year-round. Auctioneers sell oriental rugs. Hawkers demonstrate cosmetics on boardwalk corners. A stunt rider spurs her horse off a 40-foot tower into a pool—spectacular, like the rest of the State. L. B.

NATIONAL GEOGRAPHIC PHOTOGRAPHERS B. ANTHONY STEWART, VOLKMAR WENTZEL, ABOVE

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NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS NEBBIA

a week streak along the Turnpike.

Ships carrying raw materials to keep the State's factories running sail into Hudson and Delaware River ports. Stevedores load freighters with finished products for world markets.

A 15-mile corridor slants across the State from New York City toward Philadelphia. Here live three-fifths of New Jersey's 5,740,000 people. Here are 60 per cent of the State's 12,000 factories and most of its 500 industrial research laboratories.

Yet sailboats fleck the blue mountain lakes in north Jersey, another part of the "garden." Fishermen holiday at trout streams. Advertising executives and millinery buyers commute to offices in Manhattan.

Like a sliding board, the Kittatinny Mountains slope toward the Delaware River, leaving a narrow strip of flat land between. There men still trap, hunt, and trade yarns in front of wood-burning fires in country stores.

On the east side of the Kittatinnys, cows chew green grass of the valley, center of New Jersey's dairy industry.

But there are other facets besides production. New Jersey boasts 38 colleges and universities. Students gather on the steps of Blair Hall, Princeton University, above. Education ranges from the usual elementary grades to the Institute for Advanced Study, also in Princeton, a retreat where intellectual stalwarts gather to think—without classes, degrees, and exams. Here Albert Einstein, T. S. Eliot, and Arnold Toynbee worked.

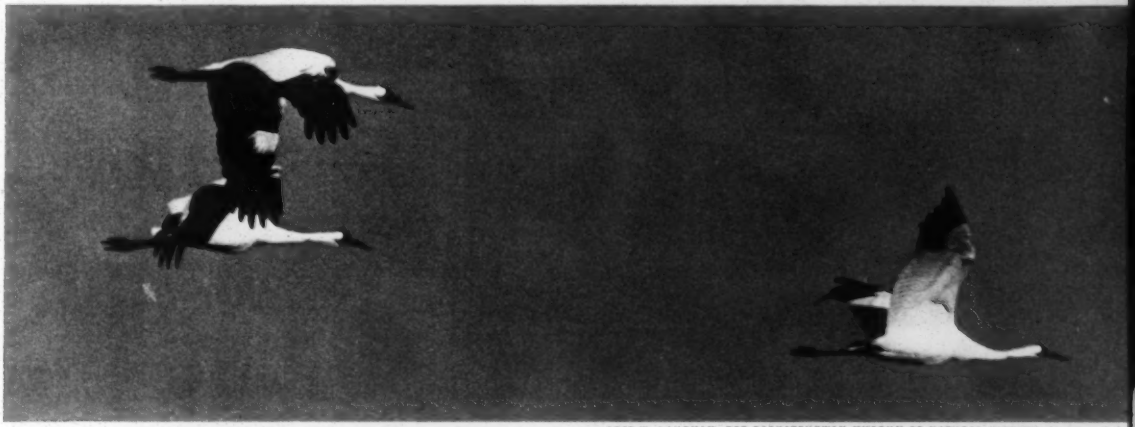
The State was named after the island of Jersey in the English channel. One of the 13 original States, New Jersey saw its share of the Revolutionary War. George Washington twice quartered his ragged, battle-weary army in Morristown for the winter. As Commander-in-Chief, he spent one-fourth of his time in the State, and moved his army across it four times. Then, as now, New Jersey was important for its location between New York and Philadelphia, and Americans and British fought hard for it. State parks on both the New Jersey and Pennsylvania sides of the Delaware River mark the landing and embarkation points of that fateful Christmas night crossing when Washington took Trenton.

Since then people of many countries have helped build the State. Before the Civil War came German ironworkers, winemakers, and brewers, English and Scottish machinists, and

d to Canada

Jersey to the Rockies. The heart of their territory was the rich prairies. As settlers moved in and drained the marshes, the whooping cranes dwindled until they seemed fated to follow the great auk and passenger pigeon into extinction.

By 1939 there were only 14 alive. Careful conservation has raised the whooping crane population to 39 birds: 33 wild and six in zoos. The month-old fellow, left, is one of a half dozen hatched in captivity.



FRED W. LAHRMAN, FOR SASKATCHEWAN MUSEUM OF NATURAL HISTORY

OMAR MARCUS

The wild birds winter at Aransas National Wildlife Refuge on the Gulf Coast of Texas. They live in families. For Mr. and Mrs. Whooper there is no such thing as divorce. Each family stakes out its marshy estate of some 400 acres, and Mr. Whooper sees to it that strangers do not intrude. He is the undisputed head of the family.

A handsome white bird, he stands five feet tall. His black-tipped wings spread a magnificent seven feet. His head is crowned with a deep red patch of bare skin.

Mrs. Whooper is a smaller model, docile and gentle. She cares for baby, finding choice tidbits for him, breaking up large crabs, and teaching him the tricks of whooping crane existence.

As winter wears on, Mr. and Mrs. Whooper dance with increasing frequency. Next month they begin their flight north to Wood Buffalo National Park, 400 miles from the Arctic Circle. The whoopers above cruise at 45 miles per hour and cover about 200 miles a day despite many food stops. The young, born in the north, will return over the same route with their families, arriving in Texas in late October or early November. L.B.

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FREDERICK KENT TRUSLOW

WHOOPING IT UP—The *kerloo, ker-lee-oo!* that gave the whooping crane its name is heard more than a mile. But this youngster manages only a piping cry.

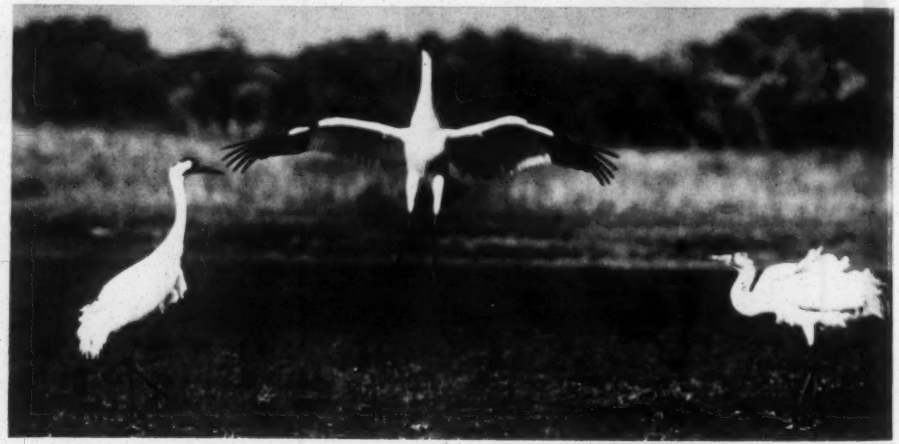
Whooping Cranes Take Highroad

ON THE WIDE, FLAT MARSHES of the Texas coast, the wild ballet rises to a climax. To their own bugling music, the whooping cranes celebrate the end of winter and prepare for the flight north.

The bird below pirouettes while wife and youngster watch entranced. He's giving his mate the crane's version of a kiss. He courts her with a dance. She answers with a dance of her own. Together they leap and gyrate during the period from mid-December until April when they take off on their annual 2,500-mile journey to their Canadian breeding grounds.

What's left of them will make the trip. They're members of a rare species. Scientists now believe the birds have been comparatively scarce since the early Ice Age. They numbered no more than 1,400 in 1870.

At one time the birds ranged from the Arctic to Mexico, from New



Solar System No. 8

Uranus, Neptune, and Pluto

IN THE COLD, DARK, farthest reaches of the solar system swing two small giants and a curious dwarf—Uranus, Neptune, and Pluto.

Even when self-centered man believed the universe hinged around his Earth, it was realized that Mercury, Venus, Mars, Jupiter, and Saturn were a special sort of near neighbors. With the sun and the moon, they made a group of seven—and seven was a magical number. Seven "planetary bodies" seemed a quite proper arrangement. No one suspected that other bodies lay beyond Saturn.

The first of these, Uranus, was discovered by a remarkable amateur astronomer (see story above). An organist by trade, William Herschel was a devoted skywatcher. In 1781, he was observing the constellation Gemini as part of a survey of the entire heaven. He "perceived one star which appeared visibly larger than the rest," as he wrote, and "suspected it to be a comet." Study showed instead a new major planet. Astronomers were staggered, and Herschel turned pro.

Uranus is a gaseous giant, similar to Jupiter and Saturn, but smaller. It turns on its axis, but that axis is not upright like the other planets we know.

Instead of spinning like a top as it circles the sun Uranus is "tilted" on its side so that it rolls through the heavens like a ball.

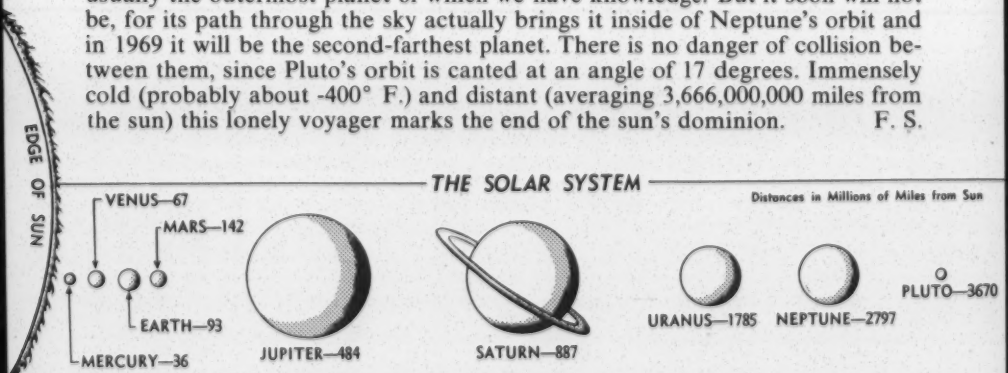
Uranus is believed to be a rock core 14,000 miles in diameter, enveloped in a 6,000-mile-thick ice layer and a coating of gases perhaps 3,000 miles deep. Since it is 1,783,000,000 miles from the sun, temperatures hover around -310° Fahrenheit. At four miles per second, Uranus needs 84 years to complete a circuit of the sun. Thus Uranus was discovered a little over two years ago—if we count by Uranian years.

Shortly after Uranus was found and its orbit worked out, it disturbed astronomers by not being exactly where they thought it should be.

Scientists decided there must be another planet beyond Uranus, whose gravity was pulling it out of line. By pure mathematics, an orbit was worked out for this ghost planet, and Neptune, the last of the giants, was found about where it had been expected. Almost a twin of Uranus, it is smaller (about 27,600 miles in diameter) and a thousand million miles farther out in space.

Neptune accounted very nicely for Uranus's movements—for about 50 years. Then Uranus began to stray again, and it eventually became clear that the solar system was not completely in hand.

Working from the wanderings of Uranus, and those found in Neptune's orbit, American astronomers puzzled out where another lonely circler of the sun might be, and in 1930 discovered Pluto. Small, light, and peculiar in orbit, Pluto is usually the outermost planet of which we have knowledge. But it soon will not be, for its path through the sky actually brings it inside of Neptune's orbit and in 1969 it will be the second-farthest planet. There is no danger of collision between them, since Pluto's orbit is canted at an angle of 17 degrees. Immensely cold (probably about -400° F.) and distant (averaging 3,666,000,000 miles from the sun) this lonely voyager marks the end of the sun's dominion. F. S.



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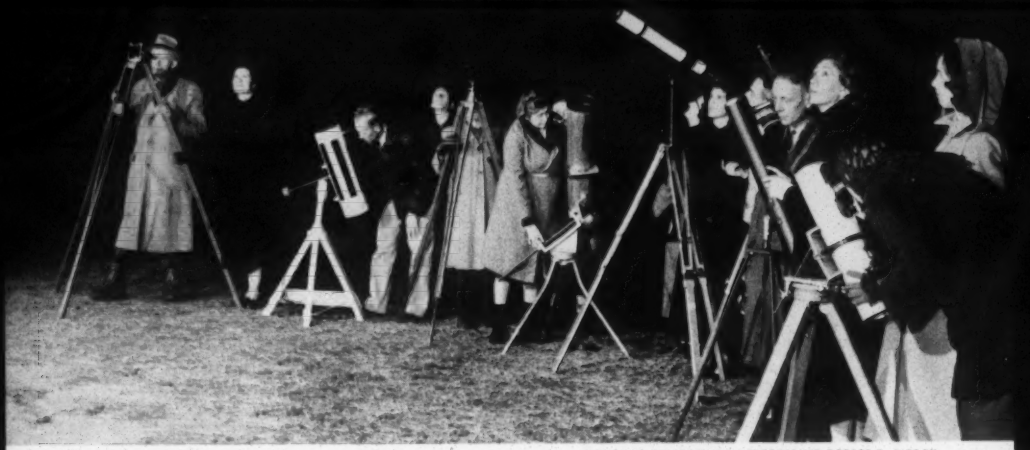
New Recruits for Oldest Fraternity

Sky Watchers



NATIONAL GEOGRAPHIC PHOTOGRAPHER ROBERT F. SISSON

EVER SINCE THE FIRST pair of cavemen stared in awe at the night sky, study of stars and planets has been an important part of man's activities.

Today, with man-made moons circling overhead, the science and hobby of astronomy have gained many new followers.

They are of all ages and all professions; many band together in groups like the National Capital Astronomers Association, photographed on an outing (above); others peer into the night alone in their backyards, out of contact with their fellows except by mail.

Part-time skywatchers have discovered many comets and meteor showers in addition to gathering a great mass of valuable data about stars and planets.

The firmament is so vast there is plenty of room for the amateur to help the professional. We still do not know the limits of the universe, but the National Geographic Society-Palomar Observatory Sky Survey has charted it to the distance of a billion light years—and a light year (the distance light can travel in a year) is six million million miles.

Most large cities have clubs of people who enjoy probing the limitless vastness. A popular activity is telescope making. Most often the instruments produced are miniatures of the 200-inch Hale telescope on Mount Palomar, California. They have a diameter of six inches. At the bottom of the cylinder (often an old mailing tube or a piece of abandoned linoleum) rests the mirror. The surface of the mirror is ground into a mathematically precise hollow that reflects the light rays on to a small mirror hung in the center of the top of the tube. This second mirror reflects the image into the eyepiece.

Making such a telescope costs less than $40, but requires about 50 hours of grinding work. Why do so many people bother?

"There's no hobby in the world more satisfying," says one West Coast amateur. "You feel like an explorer on uncharted seas, walking in worlds where other people have never been . . . And when you go exploring with a telescope you've built yourself, that's twice as much fun. You're a Columbus who's built his own ship!"

F.S.

Cairo, and Arabia brought their learning here. Timbuktu boasted one of the finest universities in Africa.

Every rich caravan that reached the Mediterranean whetted the curiosity and appetite of Europeans, but native traders jealously guarded their monopoly. Timbuktu became not only the symbol of riches, but also of remoteness and obscurity—the Lhasa of its day.

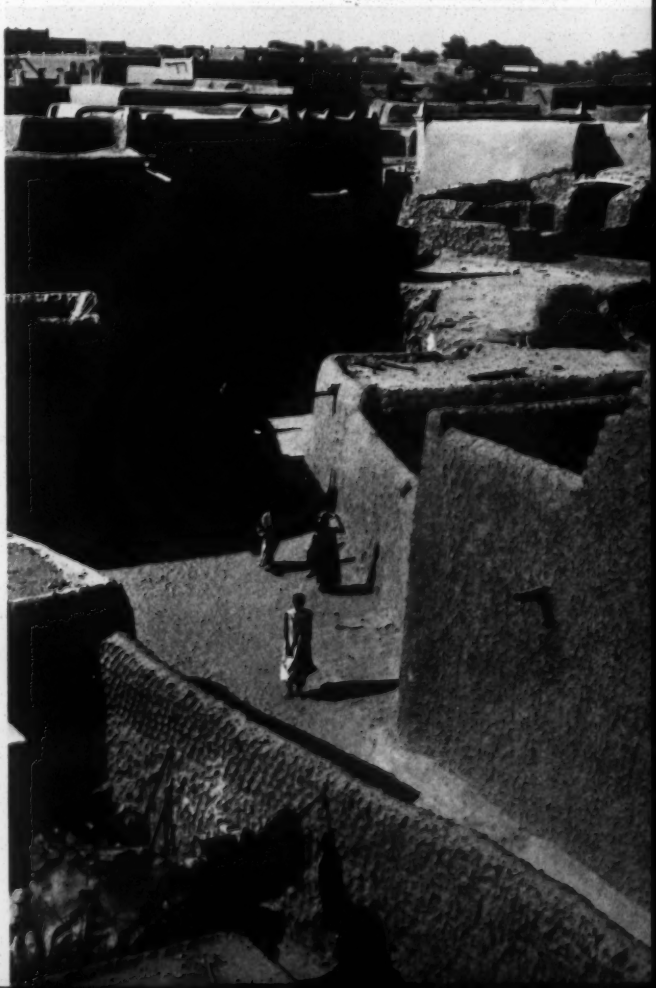
No one succeeded in piercing the veil of myth and mystery until the 19th century. The first outsider to reach Timbuktu was an Englishman, Major Gordon Laing. He was murdered five days out of the city on his way home.

In 1828 René Caillié won 10,000 francs offered by the Geographic Society of Paris to the first European to visit Timbuktu and bring back an account of his findings. The Frenchman spent two weeks in the city disguised as a Moslem.

He returned to Paris disappointed. The riches he had expected were not there. He wrote in his notebook: "I had formed a totally different idea of the grandeur and wealth of Timbuktu; it was at first view nothing but a mass of ill-looking houses built of earth . . ."

Native raiders anxious to cut in on the prosperous trade had taken their toll. In 1590, the Sultan of Morocco plundered the city. Nomadic Tuareg bands swooped down repeatedly afterwards. In 1893 the French, moving east from Senegal, brought Paris rule, unbroken until 1958 when the Soudanese Republic became a semi-independent nation within the French Community.

RICHARD HARRINGTON, THREE LIONS



The city remains today much as Rene Caillié saw it. Two-story mud and brick houses crouch beside narrow streets (right). Cool inside, they give relief from the desert heat—100 to 110 degrees in the shade—that bakes Timbuktu for eight months of the year. But the torrential rains of late summer are apt to melt the structures down.

The population of Timbuktu has dwindled from 20,000 in its heyday to 7,000—Moors and Tuaregs of the north and Soudanese and Bela from the south.

The salt trade is still the mainspring that

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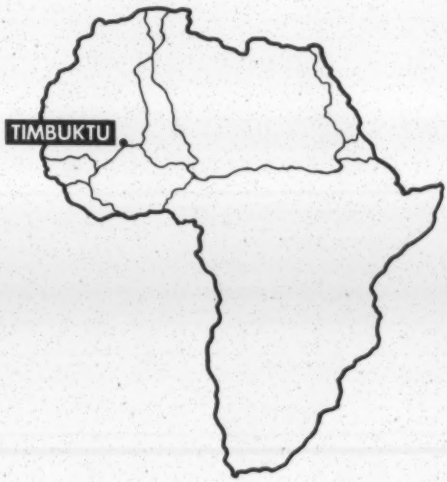
PETER WRINCH-SCHULZ

Timbuktu Loses Its Mystery

THE WELL NEAR the Timbuktu market place still gurgles as water carriers fill their goatskins. Like the boys above, they tote their *gerbas* on their heads and sell the precious fluid by the cupful. Women in flowing robes walk the city's winding streets (see cover) as they have for centuries.

But the jeweled kings and gold-laden caravans that were talked of in the fashionable salons of London and Paris in the 15th and 16th centuries have vanished like a Sahara mirage.

Timbuktu (Tombouctou) was founded as a trading center in perhaps the 11th century. It rose where the great northern bend of the Niger River laps Sahara sands, in what is now the Soudanese Republic. It was a perfect meeting place for river boat and camel, the cultures of jungle Africa and the desert (trade routes are shown on the map).



Every March and September an *azalai* (caravan) of as many as 12,000 camels carrying salt left Taoudenni, near the present Algerian border, for the market at Timbuktu, 425 miles south.

It returned with tropical Africa's riches: slaves, gold, feathers, incense, ivory, koala nuts, grain.

Through Tunis, Tripoli, and the ports of Egypt, the wealth of Africa was exchanged for the products of Manchester and Köln (Cologne).

Timbuktu grew into the metropolis of the Sahara and a center of African Moslem culture. Scholars from Tunis,

RICHARD HARRINGTON, THREE LIONS

makes Timbuktu tick. Caravans thread their ponderous way from Taoudenni twice a year. Other camel trains take on grain, cacao, dried fish, and ivory of the southeast for towns in Algeria and Morocco.

The market places are quieter today, supplying mostly local buyers. Pirogues (above) arrive in Timbuktu's port of Kabara loaded with reeds for matting and grass for the animals of the nomads. Bigger trade finds markets elsewhere. Bamako, upstream from Timbuktu, usurps its place in commerce. Trucks, planes, and trains that can't negotiate Timbuktu's marshy ground pour into Bamako, which is the capital and largest city of Soudanese Republic.

Timbuktu boys sit in the shade reciting verses from the Koran, and a few minarets spiral into the sky, echoing faintly the city's glorious days.

The city needs paved streets and electric lights. Women still bake bread in the public ovens outdoors (right).

But tourists have discovered Timbuktu. City officials are considering plans to improve hotels, streets, and lighting. New industries are to be encouraged and schools bettered. The mirage may yet repear. L.B.

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